

# Green Roof Conference Thessaloniki

## Applications of Green Roofs in European Cities

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# Outline

- The International Green Roof Association
- Why Green Roofs?
- Green Roof Policies
- Green Roof Technology
- International Case Studies

# Aims of IGRA

- Promotion of the Green Roof Idea
- Knowledge Transfer
- Sensitization of the Public
- Stimulation of International Standards
- Services: Networking, Conferences, Newsletter, [www.igra-world.com](http://www.igra-world.com)

# Why Green Roofs?



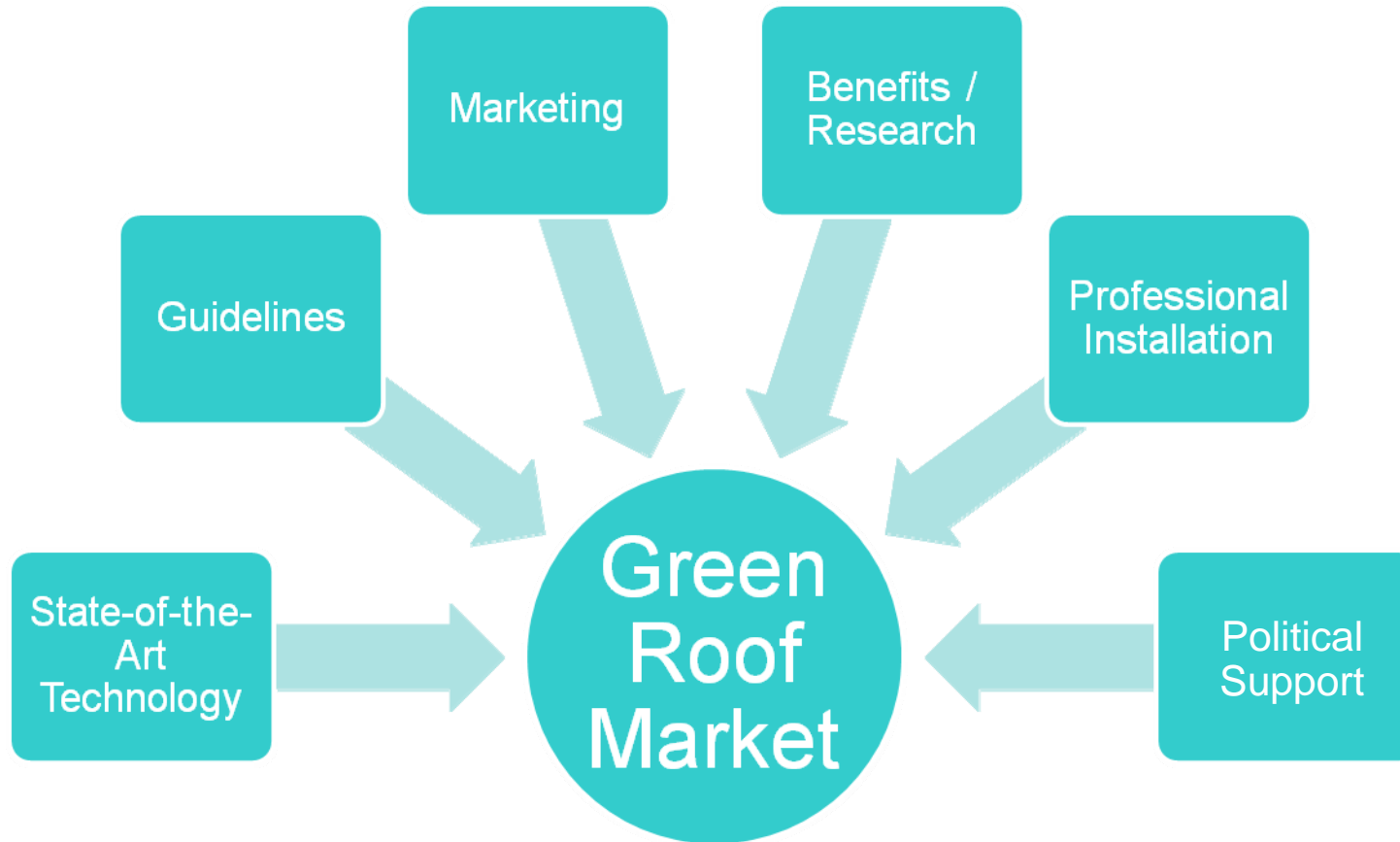
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# Ecological and Economic Benefits



# Green Roof Market – Basic Conditions



# Green Roof Policies

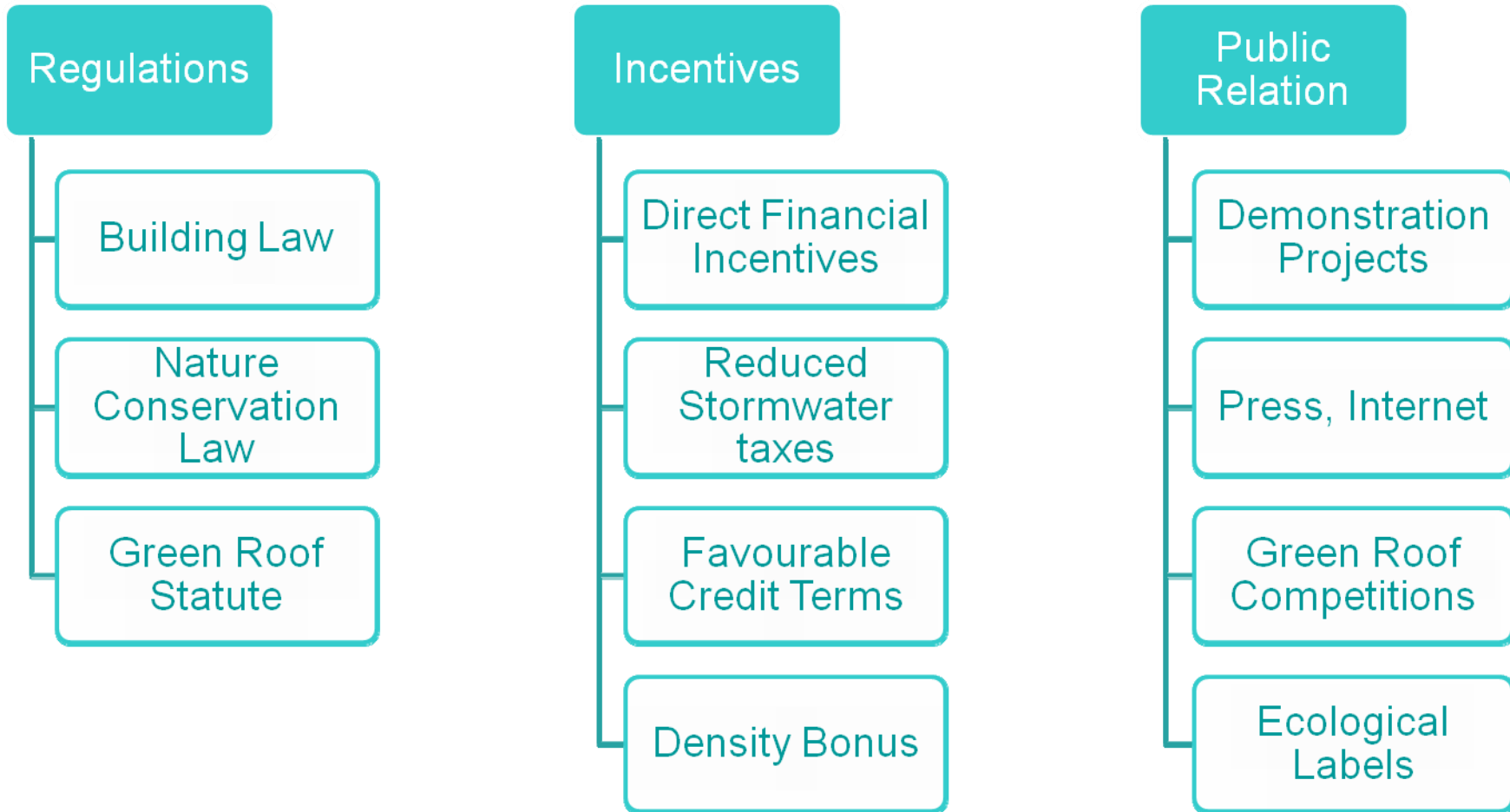


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# The Toolbox: An Overview





# Regulations: Munich - Germany

## Green Roof Statute

Start of the programme: 1996

"Suitable flat roofs and roofs with up to 20° slope have to be landscaped if the roof area exceeds 100 m<sup>2</sup> .

Exception: Roofs, which are going to be equipped with photovoltaics."



# Case Study: Berlin

Start of the programme: 2000

Annual stormwater fee:  
1.84 €/ m<sup>2</sup> of impervious surface  
(2009)

Discount for landscaped roofs:  
50% (extensive or intensive  
Green Roof)



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# Success Factors



© Umweltamt Düsseldorf

Downtown of Düsseldorf (7,2 km<sup>2</sup>)  
104,300 m<sup>2</sup> Green Roofs

Industrial Park Stuttgart (2,1 km<sup>2</sup>)  
111,470 m<sup>2</sup> Green Roofs



© Daimler AG

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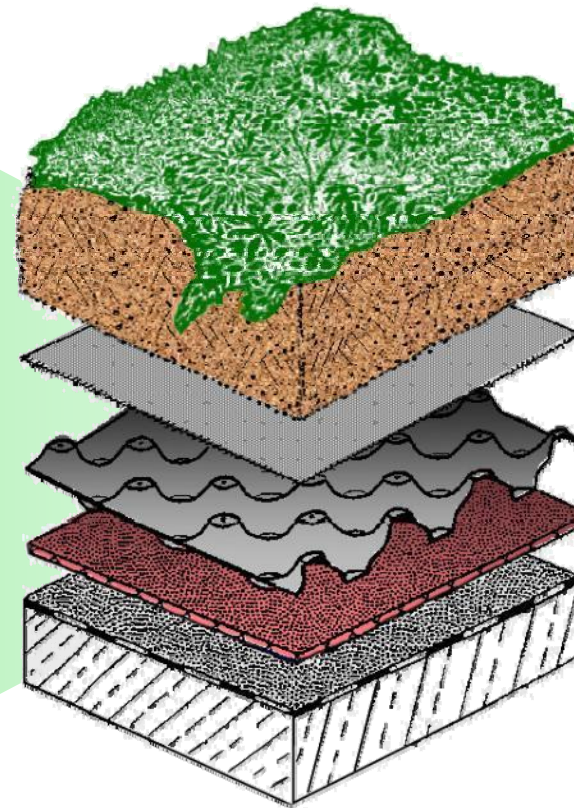
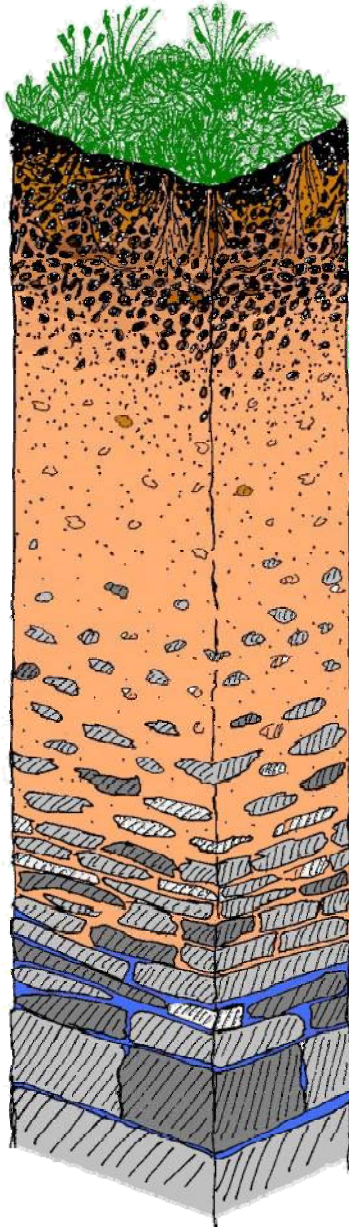
# Green Roof Technology



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# From Nature to the Green Roof Build-up



**Plant level**

**System substrate**

**Filter Sheet**

**Drainage element**

**Protection layer(s)**

# Green Roof Systems – Basic Applications

Extensive Green Roof -  
Low maintenance Green Roof



Intensive Green Roof –  
Roof Garden



# Green Roof Systems – Advanced Applications



Walkways



Driveways



Extreme light roofs



Safety Device



Pitched Green  
Roofs



Green Roofs and  
Photovoltaics

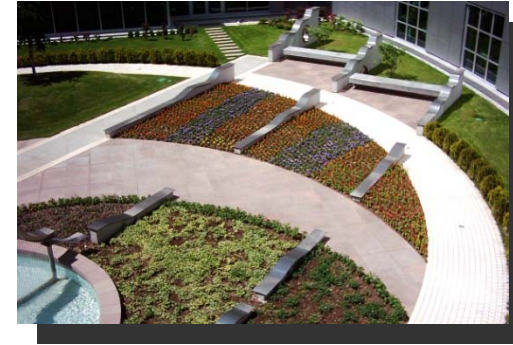
# Fully Developed Technology – Widely Applicable



North Europe



Central Europe



South Europe



Swiss Alps



Asia



North America

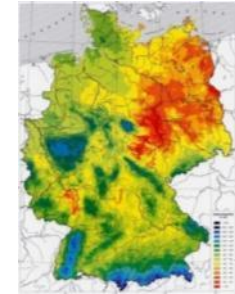


# Basic Technical Issues



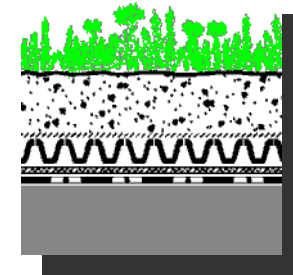
Type of greening and plant selection must correspond

Site conditions (building, climate etc.) must be observed



Application of **quality substrates** according to guidelines

Selection of the adequate **Green Roof Build-up**



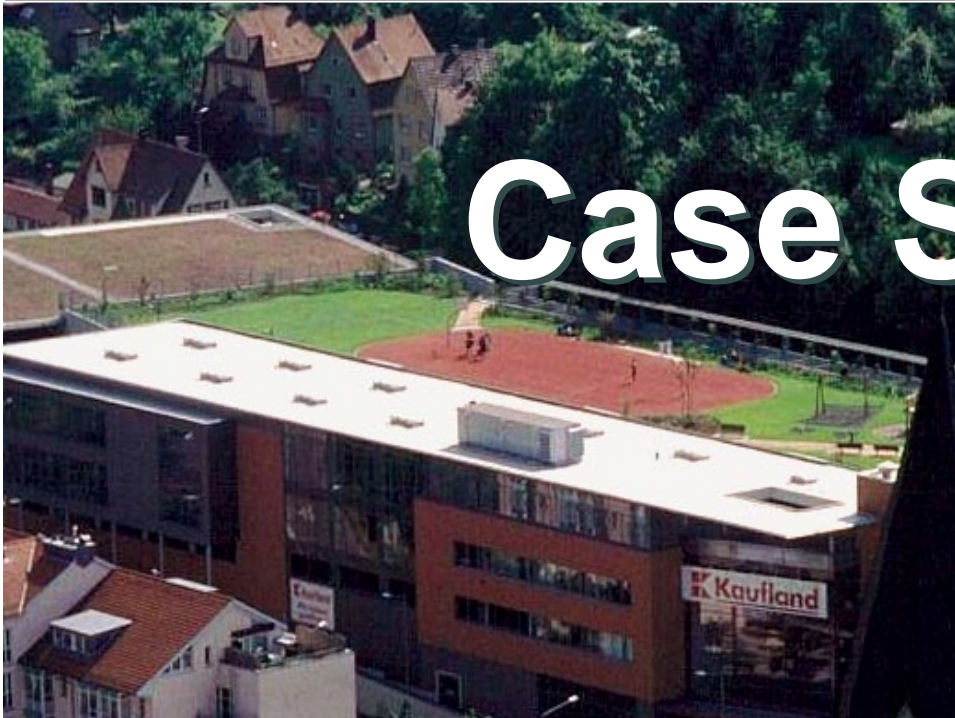
Planning of **upkeep and maintenance**

Professional installation by **Roof Gardeners**





**International**



**Case Studies**

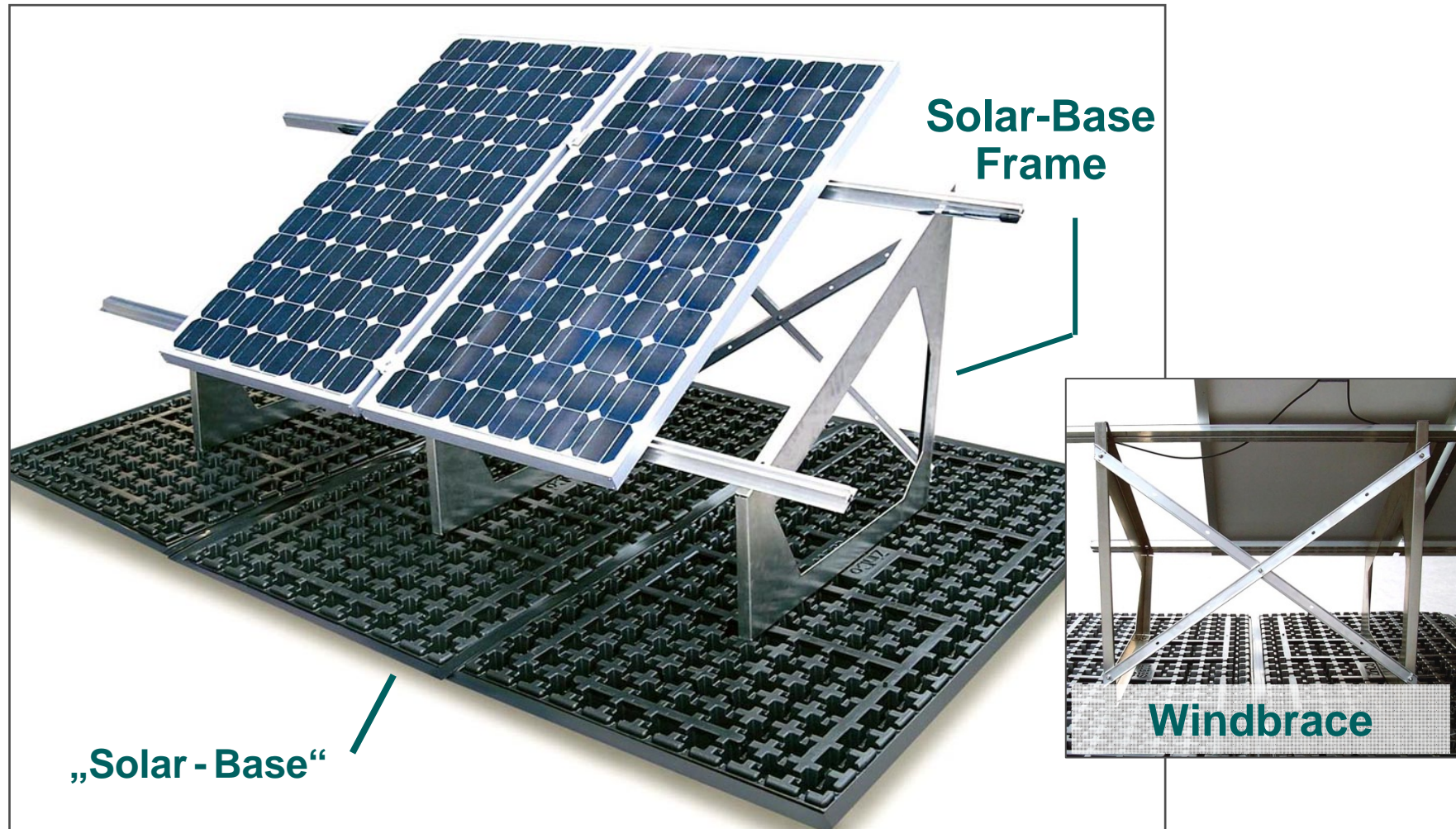
# „University Hospital“, Freiburg



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# PV-Installation on Green Roofs



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# Advantages of a Good Solar System:

- no penetration of waterproofing
- no heavy concrete - vegetation substrate provides the additional load
- load distribution - no high point loads
- no shading of solar panels, due to sufficient space



# Higher Efficiency Through Cooling Effect

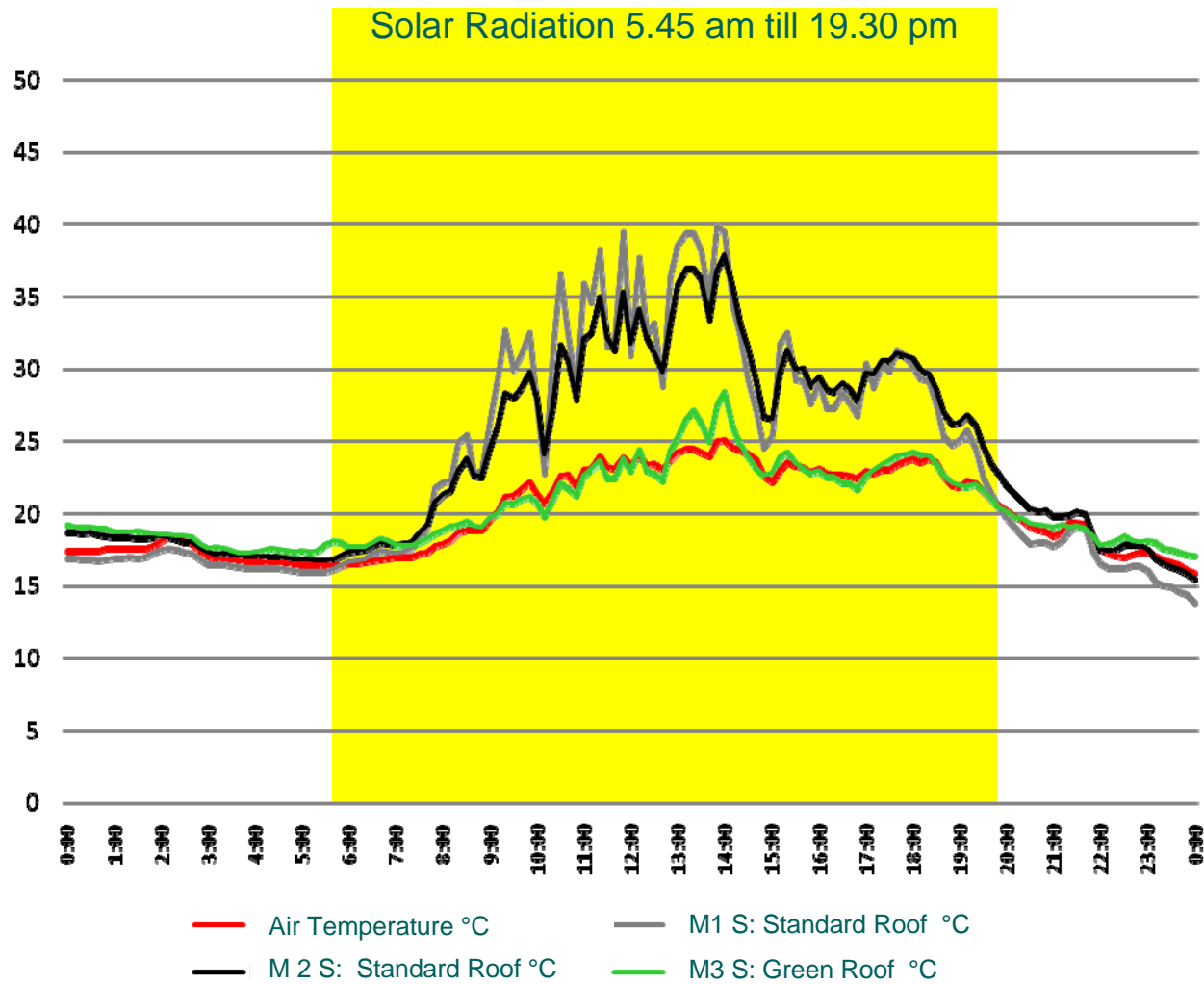
The electrical performance of photovoltaic modules are tested under "Standard Test Conditions" (STC) with different parameters.

One of the parameters is the Modul-Operating Temperature of 25°C, which is often exceeded on flat roofs during the summer months.

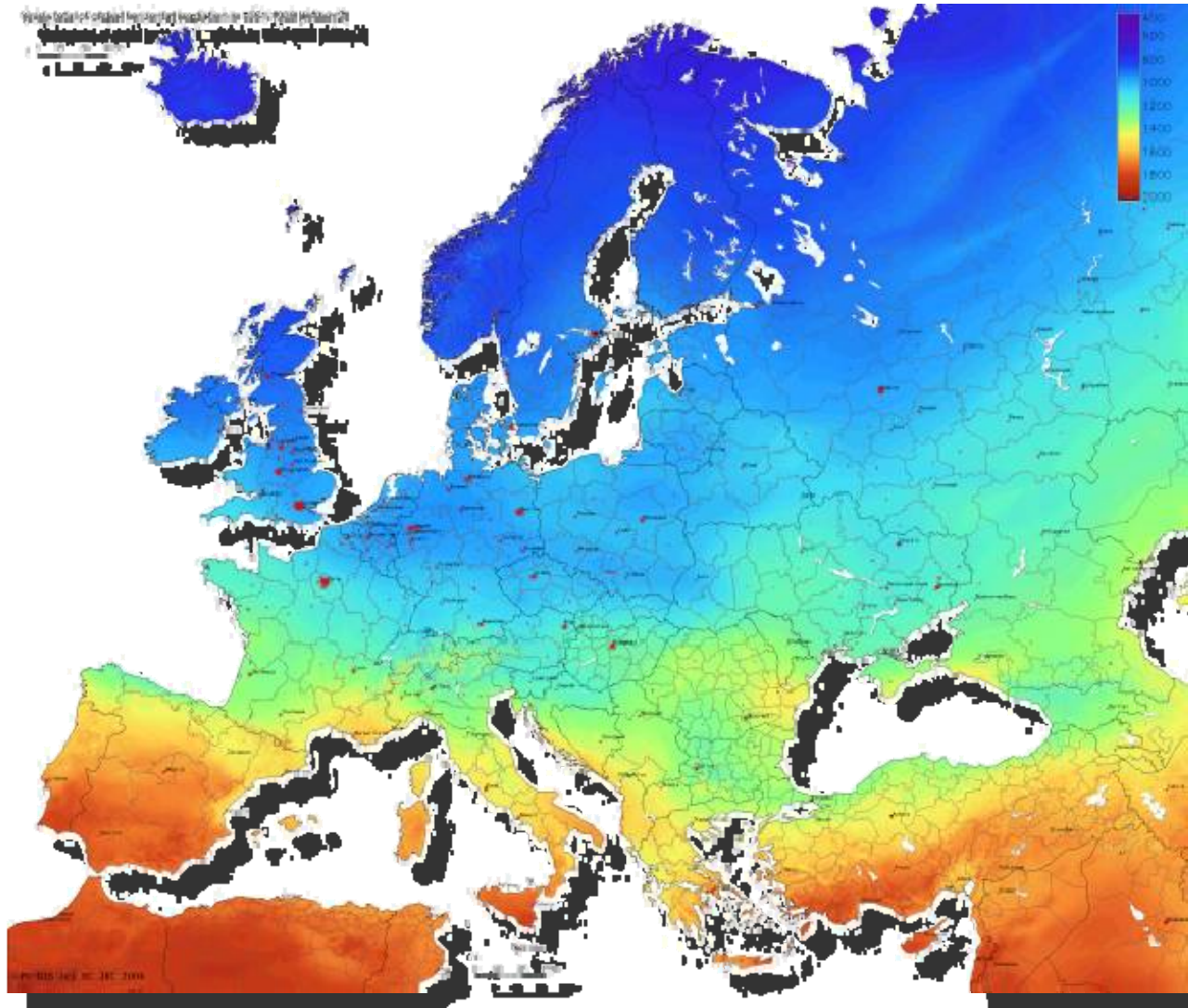
As a rule of thumb for e.g. crystalline silicon solar panels:

0,5% decrease in power supply of the photovoltaic module by increase of 1°C above the Modul-Operating Temperature of 25°C.

# Temperature Curve 6th of July 2009



# Solar Radiation in Europe



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# New Providence Building, London



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# „FiftyTwoDegrees“, Nijmegen



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# „FiftyTwoDegrees“, Nijmegen

- Requirement of Nijmegen:
  - No discharge of rainwater into the public sewer system
- Problem:
  - Little open space for infiltration
- Solution:
  - Green Roof (7.000 m<sup>2</sup>)
  - Gravel Chamber
  - Infiltration Pipe

# „Banco de Santander“, Madrid



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# „Kanyon Levant“, Istanbul



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# „Meydan-Shopping-Center“, Istanbul



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# „Meydan-Shopping-Center“, Istanbul



# „High Line Park“, New York City

# HIGH LINE

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## FROM THE BLOG

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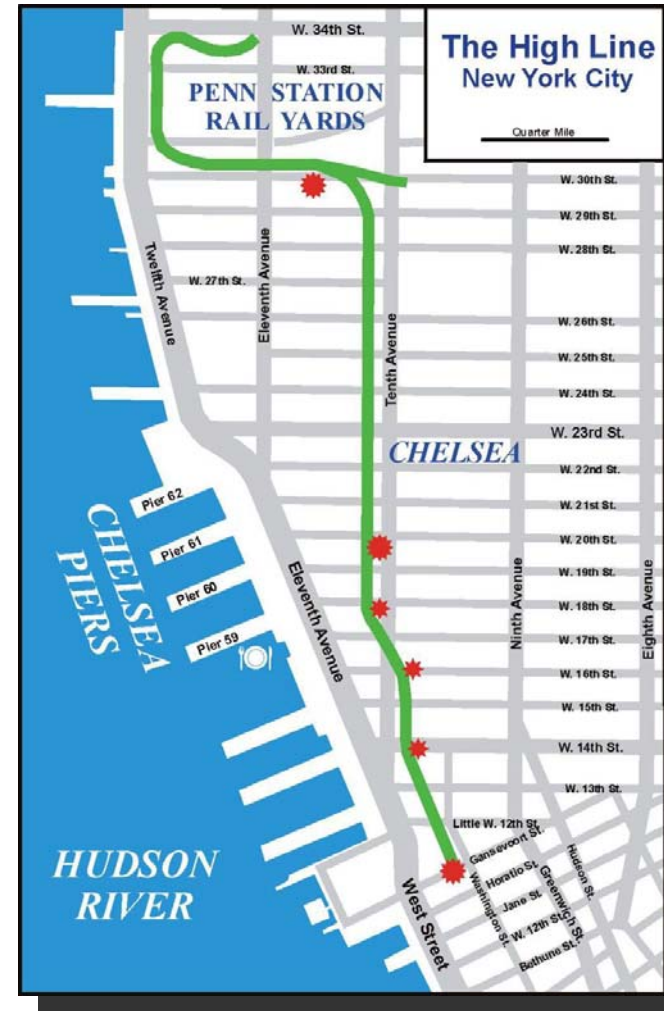
# „High Line Park“, New York City



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# „High Line Park“, New York City



# „Marina Bay Sands“, Singapore



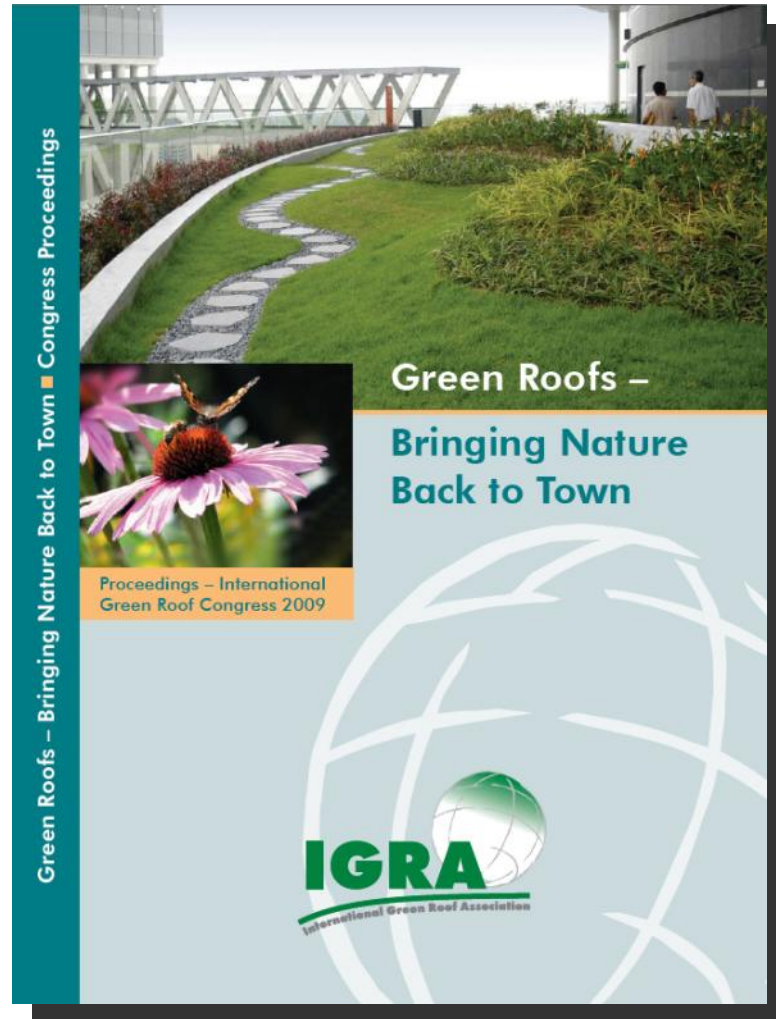
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# „Marina Bay Sands“, Singapore



# Exploring Green Roofs



## Recommended Literature

### Green Roofs – Bringing Nature Back to Town

Publisher: IGRA, May 2009

Languages: English / German

Details: [www.greenroofworld.com](http://www.greenroofworld.com)

We invite you to join the global Green Roof community

[www.greenroofworld.com](http://www.greenroofworld.com)

Green Roofs – Bringing Nature Back to Town



<a href="#">International Green Roof Association</a>	<a href="#">International Green Roof Congress 2009</a> deutsch   english	<a href="#">Congress Proceedings Tagungsband 2009</a> deutsch   english	<a href="#">Skyrise Greenery Conference 2010</a>
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SKYRISE  
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Thank you very much for your attention!